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ABSTRACT

This paper explores some of the implications on teacher education of the increased use of ICT (Information Communication Technology) in the delivery of curricula. The paper argues that, if ICT is going to become an integral part of instruction in elementary and secondary schools, changes need to be made in preservice and inservice programs for education students and practicing teachers. The initial section describes the assumptions used to limit the scope of the paper. The next section presents a discussion of potential uses of ICT and some concerns/myths about the use of ICT in education. The third section is a discussion of teacher education and professional development for practicing teachers, including some ideas about distance education. The final section is a proposal for a research facility (an instructional sending studio and receiving classroom) at the University of Regina (Canada) to further the study of ICT in teaching and learning in elementary and secondary classrooms. (MES)

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Technology in the classroom: Implications for Teacher Education

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Abstract: This paper argues that if ICT is going to become an integral part of instruction in elementary and secondary schools, then changes need to made in preservice and inservice programs for education students and practising teachers. Suggestions for assisting students to understand pedagogically appropriate uses of ICT are described. In addition a proposal for an instructional sending studio and receiving classroom is made. Uses for the facility are described and include applications at the undergraduate and graduate levels. The facility could be used to provide much needed research about the best uses of ICT in elementary and secondary classrooms.

Introduction

Rural and Northern areas in Saskatchewan have small student populations; however, the demand for an extensive range of courses has not decreased. Budgets are not large enough to allow hiring of specialists in all subject areas; nevertheless, students need these courses to fulfill requirements for entry to many post-secondary programs. In spite legislation requiring provision of equitable programs, they are becoming more difficult to deliver with limited funding.

Information communication technology (ICT) is capable of resolving these educational concerns to some extent. A variety of alternative program delivery systems/mechanisms are being suggested as means to provide equity in education in rural and northern settings. Televised and on-line courses originating from within or outside the province can be found for most subject areas. Within Saskatchewan, a few urban schools televise physics, calculus and other courses to areas where only small numbers of students want to take a course. Other courses, which originate inside and outside the province, are available on-line. However, in Canada, education is a provincial responsibility; there is no federal department of education as in the United States. Consequently, individual provincial departments of education are concerned about the quality of courses available on the Internet, and whether or not they adhere to provincial guidelines

The purpose of this paper is to explore some of the implication on teacher education of the increased use of ICT in delivery of curricula. The initial section describes the assumptions used to limit the scope of the paper. The next section presents a discussion of potential uses of ICT and some concerns/myths about the use of ICT in education. The third section is a discussion of teacher education and professional development for practising teachers including some ideas about distance education. The final section describes a research facility that author would like to see established at his university to further the study of ICT in teaching and learning.

Assumptions upon which paper is based

Because ICT has an enormous range of potential uses, some assumptions are employed to limit the scope of this paper. The assumptions are, of course, open to debate. Because of my professional classroom experience I have a good understanding of the realities of classroom teaching and learning. The suggestions made within this paper are intended to be manageable for faculties of education, school administrations and classroom teachers.

First, teachers are assumed to be doing a very good job in the classroom. They are well educated and care very strongly about their profession and their students. Teachers have a professional attitude toward the

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quality of the instruction they provide and understand much more about what actually goes on in the classroom than most computer business persons. Second, the goals and policies of education in our province (and other Canadian provinces) are delineated in provincial education documentation. In Saskatchewan this documentation (Saskatchewan Education, 1999) has a sound philosophical base and is probably the most consistent package in Canada. The uses of ICT must fit within provincial programs and philosophy. Third, some use of ICT is inevitable and desirable; however, ICT is surrounded by an enormous amount of hype and many claims, which are not supported by research. Fourth, much more goes on in classrooms than the explicit curriculum lay out in curriculum guides. In classrooms throughout Canada implicit educational goals are achieved which are not written down but are intended nonetheless. These implicit goals are of great importance in the development of citizens and must not be unintentionally eliminated through the use of ICT or any other instructional strategy. Finally, it is assumed that whatever funding is spent on ICT cannot be spent on other school programs. The result of spending considerable amounts of money on ICT means that some program is discontinued, some building repair is not made, or some teacher is not hired. Franklin (1999) argues that when technology is introduced we should remember that students matter more than computers, and that planning to implement the use of technology should be aimed at minimizing disaster.

Uses, Myths and Concerns of ICT in Classrooms

Some uses of ICT in education are more likely to occur than others. The most obvious applications for students to learn to use include, word processing, spread sheet usage, data base creation and access, presentation, multi-media software and web design software. Students will increasingly use these types of software applications as tools in completing their assignments and presenting their work. Just as obviously, teachers will increasingly use ICT for administrative and professional purposes. Computers are now routinely used to record marks, attendance, student information, and to generate reports to parents. Teachers will continue to increase their professional use of ICT for lesson planning, instruction and communication. Communication by computer between teachers and administrators is now routine and will probably grow to include some form of communication with parents.

The Internet sites are increasingly being used as resources for students and teachers, especially as budget limitations reduce the purchase of other kinds of resources. Teachers, students and parents will use email communications more extensively, and new forms of communication will almost certainly include visual images. The chat room facility of web-based software is being used by students to communicate among themselves because its asynchronous nature allows them to work together on their own schedule.

ICT is being used to provide alternative delivery of curricula, especially at the secondary and post-secondary levels. Whether with one-way or two-way student-teacher communication, courses will be offered at a distance. Teachers at the receiving end may be able to assist in facilitating learning for those students who access such instruction. Teachers involved in the sending of distance instruction will have to learn instructional skills that are not normally taught as part of teacher education courses.

Software for classroom use is targeted at each subject area in every grade level. Teachers have to learn to evaluate this software as to its suitability in their classroom situations, and learn how to use appropriate software in meaningful ways with their students. Because of limited computer resources within individual classrooms all students will not be using the computer(s) at the same time. Software and hardware are used to collect and manipulate data in senior science laboratories. Drafting software and graphic design software have been adopted for use in practical and applied arts courses. Many high school year books are being created exclusively through the use page maker software and scanned images.

Educational research has discovered a great deal about how students learn and what types of experiences are most appropriate for particular age and developmental levels. Some proposed uses of ICT in classrooms are not appropriate to the developmental level of the students. We know certain types of activities and instruction cannot work at lower grade levels because these students do not yet think abstractly. Many proposed uses suggest that students will learn on their own with little supervision. For example, some suggestions for ICT involve elementary students learning at home with little or no teaching supervision sitting in front of a computer screen working through computer assisted learning exercises. This approach may be appropriate for adult learners who work from more intrinsic motivation, but it is not likely to succeed for

younger students. Caring and interaction from teachers is an essential part of learning, especially for younger children. Students must interact with people to learn how to work with them. These abilities are developed as part of every activity and all interactions in all K-12 classrooms. While some communication skills can be developed in isolation using computers, other important forms of communication cannot be. Reading non-verbal signs are extremely important in understanding others; body language and facial expressions are not obtainable using computers alone.

The adoption of technology has led to a downgrading of personal experience in education (Postman, 1991; Franklin, 1999). Human beings are tending to devalue their common sense about educational decisions. For example, common sense tells us that ICT cannot replace teachers. Yet, in spite of this knowledge we listen to arguments that performance of students taught by computer is as good on standardized tests as those taught by teachers and begin to wonder if teachers can be eliminated. Parents in rural communities in Saskatchewan are very clear about the expectation that their children should be in the presence of teachers and other students (Fleming & Pain, 1996). Yet, in spite of this common sense conclusion we persist in considering the replacement of teachers with ICT.

A claim frequently heard is that students will be able to interact using email with the scientists (or writers, or other professionals) who made discoveries (or wrote a book). The argument goes something like, "who better to explain the discovery than the person who made it." Sooner of later, reality will set in. First, scientists (and other professionals) do not have the time to interact with a significant number of students, any more than famous actors and actresses have time to answer their fan mail. Second, a teacher may well be able to explain a discovery better than the scientist to students in his/her classroom. Scientists who work at the frontier of knowledge are not known for their ability to communicate their ideas in ways that are clearly understood by adults, let alone children. Some of the hype and dreams that pass for policy development are just that, hype and dreams.

Lastly if we look at predictions made about computers made in the last decade or so, many have not come to fruition in quite the manner predicted. Computers have a have life expectancy of less than five years, meaning that they must be replaced much more frequently than imagined. I recall someone (maybe Bill Gates) arguing no long ago that no one would ever need a computer with more the 64 kB of memory. The quality of computers has increased as they become faster and have greater memory capacity; however, the demands of new software are constantly increasing requiring ever more powerful machines to run them. The wonderful "486" of a few years ago has become a paper weight or doorstop as a new piece of software is chosen with memory requirements that exceed those of the "486". This is perfectly planned obsolescence.

The most important criterion in adopting any ICT for classroom use is that the use be pedagogically appropriate. Teachers require workshops and other experiences to assist them in understanding the uses and limits of ICT. Appropriate uses are not necessarily what are advertised by manufacturers. Teachers have to be helped to understand that as professionals they can develop new and creative uses for ICT on their own.

Teacher Education and Professional Development

Fewer educators at the elementary, secondary, and post-secondary levels than is optimal are integrating ICT into their classrooms in ways that are meaningful to students and pedagogically appropriate. Without appropriate teacher education and professional development ICT resources can be wasted. For example, computers sit idle, or are used by students to "surf the net" with no direction or plan. In spite of the great range of wonderful resources on the Internet, it can be a very ugly and unfriendly place to explore. Without supervision and censorship, students (especially younger ones) are in some danger if allowed unlimited access. Preservice and inservice teachers require workshops and other developmental opportunities in order to learn about pedagogically appropriate uses of ICT. If teachers are going to use ICT in their classrooms, then they must use it well and in such a manner as to improve education.

Preservice and inservice teachers both require assistance in learning to integrate ICT into the curricula. Inservice teachers generally have more practical experience and background than do preservice teachers. Inservice teachers are more experienced in classroom decision making. In the following preservice teachers are presumed to be enrolled in university teacher education programs and gaining their ICT experiences as part of their courses. Inservice teachers are presumed to access some form of professional

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development that could be part of a university program, but is more likely outside of a university setting. The ICT component of professional development and teacher education will in many cases be very similar.

Most advocates argue for the integration of ICT into the curricula of all subject areas. That is, ICT should not be restricted to computer science courses and computer labs; rather, students should have access to computers in each classroom for use in all courses. This approach is recommended because students need to learn to use ICT while performing problem based and authentic tasks in all subject areas. If ICT is to be available in all classrooms, then teachers will have to acquire some technical knowledge of ICT, and considerable knowledge of how to choose appropriate instructional uses for ICT in their classrooms.

Constructivist teaching, student-centred classrooms, critical and creative thinking skills, problem solving skills, and facilitation of student learning have been presented as reasons to adopt more ICT in classrooms. While all of these are desirable goals for classroom teaching, none is dependent on ICT, or even made more easily obtainable by ICT. Any and all of these characteristics can (and should) be developed with or without computers; however, achieving them is dependent on the structure of the assignments given to students, the choice of instruction, and the relationship developed between teachers and students. Constructivist teaching does not imply a particular style of instruction, rather it describes a particular model (theory) of student learning which teachers use to interpret learning in their classrooms (Millar, 1989).

Teacher education programs will still need to prepare their graduates with solid foundations in instruction, planning, educational psychology, learning theory and classroom management. None of these skills and knowledge is required in less degree if ICT is integrated into the curricula. No one is arguing that teachers need only to be able to install and to turn on a "learn to read" or some such program, and then stand back and not interfere with the "computer as teacher". Current teacher education programs need to incorporate ICT as appropriate to specific subject areas but not at the expense of other instructional skills and knowledge.

Students in teacher education programs need opportunities to incorporate the use of ICT in their studies. Preservice teachers need access to a variety of software and hardware with which they can experiment. They need opportunities to develop skills that will enable them to assess and evaluate software for use in their classes. Classroom use of ICT must be consistent with the goals of each curriculum and be age/grade appropriate. Because of the rate of change of titles and limited budgets teacher decisions must be made wisely.

Another issue, which must be addressed, is which aspects of ICT are to be included at which grades and in which subjects. Integration of ICT into the curricula seems like a simple directive, but the reality for classroom teachers is that they have so much to choose from that the task has become impossible. What are the appropriate aspects of ICT to be integrated into K-3, 4-6, 7-9, or 10-12? This concern is a policy issue and falls to other jurisdictions. Although several attempts have been made to delineate the appropriate sills and knowledge for grade levels, they have not been adopted in all curricular jurisdictions. More work needs to be done to resolve this issue. Do we postpone learning to write or read so that students can learn to "surf the net" or use computers in some other manner?

Practising teachers who are actively developing uses of ICT for their students have additional needs to those of preservice teachers. These teachers' concerns center around classroom uses of ICT and ensuring that their students are getting the best use of the available resources. The main problem, as I see it, is that classroom teachers do not have time in their schedules and lives to spend hours learning how to use various software and hardware in their instruction. Regardless of their dedication, they do not have great deals of spare time to spend learning about ICT. Many blockages can occur when working with computers and software, and each can bring an individual planning session to a halt. Without resolution the blockage stops all planning and tomorrow's lessons are not prepared. Support and professional development must be provided and be on-going. Teachers simply cannot be given an hour inservice, handed the software and be expected to use it in their classrooms the next day. Teaching is a much more complicated process than is imagined. "Just-in-time" support (assistance) has been described as a better means of assisting classroom teachers (Richmond, 1997). This type of support is designed to be available to teachers on very short notice. Support personnel must be available to assist teachers as they plan to include ICT into their instruction. Richmond argues that teachers need just-in-time support because studies have shown that they abandon ICT when the are stymied by some aspect of its use. Another solution is for an individual teacher to develop expertise with a single program and act as mentor to other teachers for that program. Professional development time must be provided in some manner by school administrations. Success of this approach is

less likely to occur if development of skills and knowledge is to be achieved on teachers' own time.

Each school division or administration has unique problems and concerns in delivering curriculum. Solutions are frequently most suitable when developed locally. One way to facilitate development of solutions to problems to ICT implementation would be to allow a teacher (or teachers) to have a "developmental semester." During a semester (or other length of time) teachers would be relieved from teaching and supervision duties and charged with exploring a local ICT problem. The goal would be for the teacher(s) to develop a resolution that would be implemented at the end of the "developmental semester". Teachers who know about the resources and personal in their communities could construct a viable resolution to the concern or problem. University faculties of education could provide advice and support to these teachers and could report in a formal manner on the locally developed solutions. Solutions could be published as research reports, but would be more useful in an electronic format in order to be more accessible. In some cases the work accomplished by teachers could fulfill part of the requirements for a postgraduate degree.

Distance education requires separate consideration because the teacher and students are not at the same location. Distance education courses can be delivered through correspondence, television or the Internet. Some form of distance education is very likely to be in rural and northern schools. Although most people think of the teacher who teaches from a distance, an increasingly important role exists for teachers (and other persons) at the receiving end. The role of assisting students who are accessing distance education has not been discussed to any great extent. In some models of distance education, persons at the receiving location may become an important component in distance education.

In preparing this paper I talked with two instructors who have taught using televised forms of distance education. One taught calculus and geometry to grade 12 students; the other taught university courses to students off-campus. Both instructors indicated that the flow of instruction was quite different from their regular classroom experience. This characteristic was the result of not being in the presence of the students. No immediate feedback was available and this lack made pacing of lessons different from regular teaching. Students were in contact by phone, but this type of communication was not the same, or as immediate, as personal face-to-face contact in a classroom. Both instructors thought that the sending teacher should be a specialist because of the skills required for this form of instruction. In distance education lessons have to be scripted more. Even referring to ones notes or lesson plan was perceived differently in distance education than in a regular classroom. Teacher education programs should develop courses and facilities to assist teachers in building skills and knowledge necessary for this type of instruction.

The second role in distance education is that of the supervising teacher (or person) in the classroom at the receiving end. Very little seems to have been written about his/her role. Courses or workshops could be developed to provide these persons with opportunities to learn how to assist students who are taking courses through distance education. Students need not learn completely on their own. This type of course would also have application for classroom teachers who are assisting students using computer-enhanced instruction. Models of distance education usually assume that students work independently without assistance. Teachers and other persons in the proximity of students are going to be asked questions, but little has been done to examine how these interactions can be made most effective.

A Proposal for a Research Facility

In closing this paper I am proposing the creation of a facility to explore research and development of the use ICT in educational settings. Establishing an ICT research facility at (or close to) a university would facilitate research and development into ICT, as well as, provide a range of opportunities for teacher education and professional development for teachers and administrators. The kind of facility I am suggesting would have state of the art equipment, which would be acquired through partnerships where possible to avoid the costly replacement every few years, and have access to the current educational software. The facility would be designed around an ICT classroom that could act as both a receiving classroom for distance education and as a classroom to model the use of ICT in practical use. In addition a sending (or transmitting) room/facility would be located in the same building so that feedback about instructional strategies could be provided immediately.

Such a facility would have uses for all educators and payback to the partners who contributed to the

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project. Preservice teachers would be able to use the facility to develop skills and knowledge required for appropriate classroom use of ICT. They could also explore various means of distance education at both the receiving and sending ends. The realities of classroom ICT use and distance education could be experienced first hand. The sending facility could also be connected to classrooms in nearby schools thus allowing elementary and secondary students to be part of the process. Teachers could experience strengths and weaknesses of distance education, and would be able to provide developmental criticism to those at the sending end. Elementary and secondary students could point out deficiencies and strengths of a particular distance education approach more rapidly than any group of adults.

During the school year or in the summer, workshops of varying lengths could be held for teachers and administrators. These workshops would be designed to assist participants in understanding the strengths and weaknesses of ICT and to help them design other uses for their individual situations. Graduate students could interact with these persons to design research that would examine various components of projects. Graduate programs of research at masters and doctoral levels would be able to make use of this facility to evaluate or develop educational uses of ICT. Partners would benefit in that they would receive feedback about the hardware and software from educators in a variety of educational roles. This type of facility would benefit all members of the educational community in Saskatchewan (and probably a lot of other places).

Closing Thoughts

Public demand will ensure that some ICT makes its way into the classrooms of Saskatchewan and other jurisdictions. The most important consideration is that ICT act a resource and tool for students and teachers, and not come to drive education in the province. Student learning will always be a slow, challenging process and teacher instruction will always be a challenging and rewarding process. Learning is a cognitive process that occurs in minds of children (and teachers) as the result of knowledge construction that individuals carry out to make sense of their experiences. ICT will not change the way people learn. Knowledge building is an individual process that cannot be handed over to computers. ICT must not be portrayed as a technological panacea for educational concerns.

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